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PD/P8-10: Validation of Linear Gyrokinetic Simulation of Alfven Eigenmodes in DIII-D Tokamak and Dynamics of Nonlinear Frequency Chirping

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To accurately predict confinement properties of energetic particles in burning plasmas, fully self-consistent simulations must incorporate kinetic effects of thermal and energetic particles, nonlinear interactions of many shear Alfven eigenmodes, and cross-scale couplings of microturbulence and shear Alfven wave turbulence. Global gyrokinetic turbulence codes have recently been adapted for kinetic simulations of reversed shear Alfven eigenmode (RSAE), beta-induced Alfven eigenmode (BAE), and toroidal Alfven eigenmode (TAE). Here, we report the verification and validation of linear gyrokinetic simulations of Alfven eigenmodes and the nonlinear physics of fast chirping modes at the BAE frequency. In particular, gyrokinetic simulations of the frequency sweeping and the transition from RSAE to TAE in DIII-D reversed shear plasmas are in good agreement with experimental measurements. Nonlinear gyrokinetic simulations find that BAE frequency has a fast chirping associated with the oscillation of the mode amplitude induced by the nonlinear evolution of phase space coherent structures.

Country or International Organization of Primary Author

USA

Primary author: Mr LIN, Zhihong (USA)

Presenter: Mr LIN, Zhihong (USA)

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